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(54) Title: EDIBLE FOOD IMPROVING COMPOSITION WITH DEFERRED ACTIVITY (57) Abstract Edible composition comprising a first component and a second component being capable of interacting in an aqueous food system, both as particles encapsulated or coated by a fatty substance which is degradable during processing of the food system so as to defer the interaction between the components. The components can be baking powder components, gelling agents, enzymes or aroma compounds. The composition can be used in aqueous food pre-mixes.		

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EDIBLE FOOD IMPROVING COMPOSITION WITH DEFERRED ACTIVITY

FIELD OF INVENTION

The invention pertains to the field of food system processing where it is desired to defer a certain chemical or physical effect or activity during said processing until at a pre-selected point in time or until specific conditions are present. Specifically, the invention has made it possible to provide a method of preparing food products based on the use of liquid pre-mixes comprising food product ingredients.

10 TECHNICAL BACKGROUND AND PRIOR ART

During processing of food systems such as e.g. heat treatment it is often required that certain chemical or physical effects is achieved to obtain the finished food product.

As an example, doughs or batters generally contain a chemical leavening agent which during the baking step generates gas to provide the desired structure and volume of the finished baked product. Conventional chemical leavening agents are mixtures of a basic component such as a hydrogen carbonate, and an acidic component such as e.g. a phosphate. When these two components are brought into contact in an aqueous medium such as in the dough or the batter and heated, CO₂ is generated. Such two-component leavening agents, however, are not stable in aqueous media, since they will interact herein and gradually loose their gas generating activity. It is therefore required that they are added in dry form to the dough or the batter immediately prior to baking.

It has therefore hitherto not been possible to provide liquid dough or batter pre-mixes containing the leavening agent. It is evident that such pre-mixes would be highly advantageous and convenient, since it would thereby be possible to provide pre-mixes containing all the required ingredients or all the

required ingredients except the flour, and the only step to be carried out would be to bake the ready-to-bake dough or batter or to add the flour to the liquid pre-mix and mix the two ingredients to provide a ready-to-bake bakery product system.

The present invention provides the means of generally providing liquid, aqueous pre-mixes for food systems which optionally are to be mixed with other food ingredients to provide a food system which is subjected to further processing and which pre-mixes contain reactive components which are normally not stable in aqueous media or which, when they are present together in an aqueous environment, interact with each other, in a form where their activity is retained for up till several months and their interaction is prevented prior to the processing of the food system.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides in a first aspect an edible composition comprising a first component and at least one second component, the components being capable of interacting in an aqueous food system when they are brought into contact, said first and second components both being in the form of particles encapsulated by a fatty substance which is degradable during processing of the food system whereby the components are brought into interacting contact, so as to defer the interaction between the components until at a selected point in time during processing of the food system and/or storage of the finished food product resulting from the processing, with the proviso that the interaction of the components does not result in a Maillard reaction and subject to the limitation that when the composition comprises a first component which, when it is brought into interacting contact with the second component, generates a gas, it is not comprised in a pourable cake mix.

Specifically, the invention provides compositions comprising one or more components of a leavening agent in a storage stable form.

5 In a further aspect, there is provided a method of producing a food product, comprising processing a food system comprising the above composition under conditions where the encapsulating substance encapsulating the first and second components is disintegrated whereby the components are brought into an interacting contact.

10 DETAILED DISCLOSURE OF THE INVENTION

The edible composition according to the invention comprises a first component and a second component which, when they are in contact, are capable of interacting in an aqueous food system, which first and second components are in the form of
15 particles encapsulated by an encapsulating fatty substance which is disintegratable or degradable during processing of the food system.

In the present context, the expression "food system" refers to a mixture of all the ingredients of a particular food
20 product prior to the processing steps which results in the finished food product. Typically, such processing steps include a heating step such as boiling, frying, microwave cooking or baking. As used herein, the expression "disintegratable or degradable" refers to any physical or chemical
25 condition under which the encapsulating substance is broken down or disrupted to an extent that permits the first and second components to being in interacting contact. Thus, the encapsulating substance may e.g. be disintegrated by heating to above its melting point, by dissolution or by enzymatic
30 degradation. It will be understood that the term "encapsulating" is equivalent to the term "coating" which is frequently used in the art.

The first component of the composition is one which is capable of interacting in the aqueous food system with a second component when the first and the second component is brought into contact with each other so as to provide a
5 desired effect in the food system and/or in the finished food product. The first and the second components are present in the composition according to the invention in an encapsulated form whereby the interaction between the first component and the second component is prevented until the encapsulating
10 substance of the first and the second components is degraded so as to bring the two components into an interacting contact with each other.

The first component can be selected from any active component which can interact in a food system with a second component.
15 One example of such a first component is a component of a chemical leavening agent, also referred to in the art as a baking powder. Other examples include a precursor for an aroma compound (or flavouring compound) which when interacting with a second component is converted into the fully
20 active aroma compound, an enzyme having as its substrate or as a co-factor herefor a second component which is present in the food system, or the first component may be a hydrocolloid which only forms a gel in the presence of a particular co-factor as the second component, such as e.g. a metal ion.

25 Whereas the two components of the composition according to the invention can be encapsulated by the same fatty substance, it may, however, in specific embodiments be advantageous that the first and the second components are encapsulated by different fatty substances. Thus, it is possible to
30 have the components encapsulated by two different fatty substances having different melting points whereby, if desired, one component can be released prior to the release of the other component. In specific embodiments, the difference in melting points between two encapsulating fatty acids
35 is at least 5°C, such as at least 10°C including at least 15°C e.g. at least 20°C.

The encapsulated component particles can be provided by various conventional methods for encapsulating solid particulate matters. Thus, it is possible to use a "matrix coating" process as it is described in the following

5 examples. The encapsulated particles resulting from such a process are generally in the form of primary particles of the first or second component which are intermixed intimately with the melted fatty substance followed e.g. by a spray cooling step. In another process for preparing the encapsulated component particles according to the invention, the

10 primary component particles are brought into a fluidized state and the fatty substance in melted state is applied to the thus fluidized particles by spraying. The resulting encapsulated particles will then be in the form of particles

15 comprising an inner core of the primary component particles and an encapsulating or coating layer of the fatty substances surrounding the inner core.

Although it is generally sufficient to subject the first and second components to a single step of encapsulation as

20 described above, it is also possible that at least one of the first and second components is encapsulated in more than one step to provide particles encapsulated by two or more layers of fatty substance. Compositions containing at least one component that is encapsulated by several layers of fatty

25 substance, i.e. having a thicker encapsulation are useful in food systems where it is desired to defer the interaction between the components until at a relatively late stage of the food system processing. When a first and/or second component is encapsulated by two or more layers of fatty sub-

30 stance, these layers may be of the same fatty substance, but the fatty substance layers may also be different including different fatty substances having different melting points. It will be understood that it will be possible to provide one of the first and second components with two or more layers of

35 fatty substance to obtain a retardation of the release of that component relative to the release of the other compo-

ment, e.g. by at least 1 minute, such as by at least 2 minutes including by at least 5 minutes.

In a specific embodiment, the two-component composition according to the invention comprises a mixture of separate
5 encapsulated particles of the first and the second components (primary particles). In another specific embodiment, such primary particles of the individual first and second components may be surrounded by a further common layer of an encapsulating substance so as to form secondarily encapsu-
10 lated particles comprising both of the first and the second components. In such an embodiment, the further (secondary) common encapsulating layer may be of an encapsulating substance which is different from the substance(s) used for encapsulation of the primary particles. Thus, the further
15 encapsulating substance may be a hydrocolloid, a polymer or a fatty substance, which e.g. has a melting point or a solubility being different from that of the fatty substance of the primarily encapsulated component particles.

Although it is presently preferred that the composition
20 according to the invention comprises a first component and one second component, it will be understood that it may contain two or even more second components, in particular when an interacting effect is dependent on the presence of two or more second components.

25

It is also possible to have conventional food additives incorporated into the composition, such as e.g. flavouring agents, colouring agents, gelling agents, thickening agents, antioxidants or preserving agents which are incorporated into
30 the encapsulated particles of the first and/or the second component either incorporated into the encapsulating substance or mixed with first and/or second component. Such food additives may also be added to the composition as separate non-encapsulated components. Additionally, the composition
35 may comprise conventional bulking agents.

The primary objective of providing the first and second components of the composition in the form of encapsulated particles is, as it is mentioned above, to defer the interaction in the food system between the first component and the second component until at a selected point in time during processing and/or storage of the finished food product resulting from the processing. The term "selected point in time" indicates that the type of encapsulating substance and the amount of the layer of this component is selected so as to control during the processing of the food system the point in time when the encapsulating substance(s) is/are disintegrated or degraded to an extent permitting the release of the first component and the second component whereby the two components are brought into contact to provide the desired effect. The conditions under which the degradation of the encapsulating substance is effected depends on the type of this component. When a water soluble secondary encapsulating substance is used, the degradation will be triggered by adding the composition to an aqueous phase. When the encapsulating substance is a fatty substance, the degradation of the component will occur as a result of the heating of the food system, the point in time when this occurs depending on the melting point of the substance and the amount of the encapsulating layer of the substance. In accordance with the invention, it is therefore possible to select fatty encapsulating substances having varying melting points in the range of 20 to 100°C, such as e.g. having melting points in the range of 40 to 80°C including the range of 50 to 70°C.

In other embodiments, the degradation of the encapsulating substance results from the activity of an enzyme being present and active in the food system during processing, or from changes of the chemical or physical conditions occurring in the food system during processing or in the finished food product during storage. Examples of such changes include changes of pH, water activity or enzymatic activity.

Examples of preferred encapsulating substances include edible fatty components, hydrocolloids and polymers.

Of the above components, fatty substances are particularly preferred. Suitable fatty substances include monoglycerides, diglycerides, triglycerides or mixtures hereof. Mono- and diglycerides can be further esterified with other organic acids such as acetic acid, lactic acid or citric acid. The fatty acids of the above mono-, di- or triglycerides may be saturated or unsaturated fatty acids containing e.g. 6 to 22 carbon atoms such as 14 to 20 carbon atoms. By using glycerides with differing fatty acid chain lengths and degrees of saturation, the melting point of the encapsulating substance can be pre-selected. In preferred embodiments, the glyceride is an acylated glyceride, particularly useful substances being acetylated glycerides (also referred to as acetoglycerides) including acetylated monoglyceride. It is also contemplated that lecithins can be used as the encapsulating substance.

It was found that, when a fatty substance is used as the encapsulating substance, it is preferred that the substance occurring around the encapsulated components is in a crystalline state such as in β - or β' -crystalline state.

In accordance with the invention, further useful fatty substances include polyglycerols and waxes such as carnauba wax, candelilla wax and bees wax.

Evidently, several of the above fatty substances have emulsifying activities. Accordingly, it is contemplated that when such substances melt during the processing step, they may impart an emulsifying activity on the food system being processed.

Other substances which are useful as secondary encapsulating substances according to the invention include protein hydrocolloids of animal origin such as gelatin and carbohydrate

- hydrocolloids of plant or microbial origin. This group of hydrocolloids are generally grouped as linear (cellulose, amylose, pectin, carrageenan, alginate and agar), single branch (dextran), substituted linear (locust bean gum, guar gum) and branch-on-branch (amylopectin, gum arabic) hydrocolloids. The encapsulating substance can also be one of such hydrocolloids which are chemically modified such as e.g. carboxymethyl cellulose (CMC), cellulose acetate butyrate, or modified starches, including as an example a starch adipate.
- 10 It is also contemplated that edible polymers such as e.g. polyvinylpyrrolidone, polyethylene wax, ethylene/vinyl acetate copolymer or phthalate compounds, can be used in accordance with the invention as the secondary encapsulating compound.
- 15 In a particularly useful embodiment of the invention, the composition comprises a first and a second component, which are components of a gas generating system. Such a gas generating system can be used in any food system where it is desired to obtain generation of gas during the processing of
- 20 the food system and/or during storage of the finished food product.

In preferred embodiments of the invention the gas generating system comprises as one of the first and second components an acidic component and as one of the first and second components a basic component. In the present context, suitable acidic components include acid salts, organic acids and lactones. Examples of acid salts include monocalcium phosphate monohydrate, acid phosphates such as disodium pyrophosphate, sodium aluminium phosphate, dicalcium phosphate dihydrate, sodium aluminium sulphate, alkaline and

25 earth alkaline salts of organic acids such as of citric acid, tartaric acid or adipic acid. In the present context, suitable organic acids include acetic acid, lactic acid, oligo- and polymers of lactic acid. citric acid, malic acid, fumaric

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acid, succinic acid, glucuronic acid and galacturonic acid. A suitable lactone is glucono-delta-lactone.

In suitable embodiments, the basic component is selected from the group consisting of a carbonate and a hydrogen carbonate
5 such as e.g. NaHCO_3 , K_2CO_3 , NH_4HCO_3 or $(\text{NH}_4)_2\text{CO}_3$.

As it mentioned above, the thickness or the amount of the encapsulating substance may be varied e.g. so as to control the point in time where it becomes degraded to release the encapsulated component, the degradation e.g. being effected
10 by melting of the component. In useful embodiments of the invention, the edible composition comprises an amount of encapsulating substance which is at least 25 wt%, calculated on the composition. This amount may suitably be at least 30 wt% such as at least 40 wt% or at least 50 wt%.

15 When the composition according to the invention comprises a gas generating system, the amount of the acidic component or the basic component is typically in the range of 0-90 wt% such as in the range of 1-60 wt% including the range of 10-40 wt%.

20 In addition to providing a composition which comprises components forming a gas generating system as described above, the present invention has also made it possible to provide compositions according to the invention that comprise a first component which is capable of interacting with a
25 second component to provide other effects in the food system than that of generating a gas.

In one example hereof, one of the first and second components is a precursor for an aroma (flavouring) component which, when it is brought into interacting contact with the other of
30 the first and second components is converted into the aroma component. Thus, it is known that flavouring components of vegetable such as onions, cucumbers or mushrooms are present in the native, non-processed vegetable as compounds not

having the flavouring intensity as when the vegetables are cut or minced, and it is believed that the "activation" of the aroma or flavour is due to enzymatic activity such as oxidizing enzymes. The present invention has made it possible to incorporate into a food system a precursor for such an aroma compound and an activating component which, when it is brought into contact with the precursor, converts it to the aroma component.

A further example of the usefulness of the composition according to the invention is a composition wherein one of the first and second components is a non-gelling hydrocolloid and the other of the first and second components is a salt which, when it is brought into contact with the hydrocolloid, causes the hydrocolloid to gel. One example of such a use is the sodium salt of kappa carrageenan which in itself is non-gelling, but which requires the presence of metal ions such as e.g. calcium ions to form a gel. In such an application, the composition according to the invention comprises these two components such that they are not brought into contact until the encapsulating substance or substances is/are degraded during processing of the food system. Typically, such a food system is a fruit or vegetable based food system where it is desired to obtain a gelling which is deferred until the processing of the system, e.g. heating of the ingredients.

The composition according to the invention may be in the form of a liquid, aqueous composition or it may suitably be in the form of a viscous or paste-like composition. In particularly preferred embodiments the composition is a powder, e.g. having a moisture content which is at the most 10 wt%. The particles of such a powder composition according to the invention preferably have an average largest diameter which is in the range of 50 μm to 1000 μm such as a range of 100 to 500 μm .

It will be understood that the composition according to the invention may contain any further components which are useful as ingredients in a food system and which the skilled artisan can readily select. Thus, the composition may be provided as
5 a dry or a pourable aqueous pre-mix for a particular type of food system comprising one or more ingredients typically used in such a food system. An example hereof is a liquid pre-mix for preparing a bakery product which in addition to the first and second components contains conventional bakery product
10 ingredients such as sugar, egg, water binding agents, fat, emulsifiers, preservatives, salt, flavouring agents or flour.

The encapsulated components of the composition according to the invention is typically provided by admixing the active component with the encapsulating substance under conditions
15 where the encapsulating substance is in a liquid or dissolved state followed by subjecting the mixture to a process step permitting the encapsulating substance to become solid. Such a process step may e.g. be a spray drying step, a spray cooling step, a drying step or a chemical treatment causing
20 the encapsulating substance to become a coherent solid layer surrounding the active first and/or second component. The process of preparing the composition can also be one wherein the primary, non-encapsulated component particles are brought into a fluidized state and the encapsulating substance is
25 applied onto the fluidized particles.

In a further aspect, the invention pertains to a method of producing a food product, comprising processing a food system comprising a composition according to the invention under conditions where the encapsulating substance(s) is/are
30 degraded. The conditions under which degradation of the encapsulating substance or substances occurs include heating which e.g. will cause a fatty encapsulating substance to melt. A typical example hereof is the heating conferred to a dough or batter mixture during baking hereof. Such conditions
35 may also include dissolution of the encapsulating substance in the aqueous phase of the food system either immediately or

during processing of the system or during storage of the finished food product. The encapsulating substance may also be one which is degradable under particular pH conditions in which case the degradation will occur either during processing if a pH change occurs or during storage of the finished food product during which a pH change takes place.

In useful embodiments, the method according to the invention is a method wherein the food system is a bakery product premix or a food system which is selected from the group consisting of a meat product mixture, a milk-derived product, a fruit product mixture and a vegetable product.

EXAMPLE 1

A dry gas generating composition was prepared which consisted of a mixture of particles of

- 15 (i) 20 wt% sodium hydrogen carbonate (basic component) encapsulated with a commercial monoglyceride of saturated fatty acids (Dimodan™, Danisco Ingredient, Brabrand, Denmark). The weight ratio between the active component and the encapsulating substance was about 4:6, and
- 20 (ii) 30 wt% of disodium pyrophosphate (acid component) also encapsulated with Dimodan™ at a weight ratio of 6:4.

The two components were mixed separately under stirring conditions in the melted fatty substance and subsequently spray cooled and stored to permit the encapsulating substance to solidify and to be transformed into the β -crystalline state.

EXAMPLE 2

Particles were prepared separately as described in Example 1 under (i) and (ii), respectively and subsequently combined and subjected to a further encapsulation step to provide
5 secondary encapsulated particles containing both active components.

EXAMPLE 3

A composition of the same general composition as that obtained in Example 1 was prepared by mixing 20 parts of
10 sodium hydrogen carbonate, 30 parts of disodium pyrophosphate with 50 parts of melted Dimodan™ followed by spray cooling the mixture.

CLAIMS

1. An edible composition comprising a first component and at least one second component, the components being capable of interacting in an aqueous food system when they are brought
5 into contact, said first and second components both being in the form of particles encapsulated by a fatty substance which is degradable during processing of the food system whereby the components are brought into interacting contact, so as to defer the interaction between the components until at a
10 selected point in time during processing of the food system and/or storage of the finished food product resulting from the processing, with the proviso that the interaction of the components does not result in a Maillard reaction and subject to the limitation that when the composition comprises a first
15 component which, when it is brought into interacting contact with the second component, generates a gas, it is not comprised in a pourable cake mix.
2. A composition according to claim 1 wherein the first and second components are encapsulated by different fatty sub-
20 stances.
3. A composition according to claim 2 wherein the different fatty substances have different melting points.
4. A composition according to claim 1 wherein at least one of the components is encapsulated so as to provide the component
25 as a core that is surrounded by the fatty substance.
5. A composition according to claim 1 wherein at least one of said first and second components is encapsulated in two or more steps to provide particles of the component encapsulated by two or more layers of fatty substance.
- 30 6. A composition according to claim 5 wherein the fatty substance of the two or more layers are different.

7. A composition according to claim 6 wherein the different fatty substances have different melting points or solubility.
8. A composition according to any of claims 1-7 wherein a mixture of encapsulated particles of the first and the second component is encapsulated by a further encapsulating substance to form secondarily encapsulated particles comprising the primarily encapsulated particles.
9. A composition according to claim 8 wherein the further encapsulating substance is selected from the group consisting of a fatty substance, a hydrocolloid and a polymer.
10. A composition according to any of claims 1-9 comprising a first component which, when it is brought into interacting contact with the second component, generates a gas.
11. A composition according to claim 10 wherein one of the first and second components is an acidic component and one of the first and second components is a basic component.
12. A composition according to claim 11 wherein the acidic component is selected from the group consisting of a phosphate, a sulphate, a lactone, an organic acid and an organic salt.
13. A composition according to claim 11 wherein the basic component is selected from the group consisting of a carbonate and a hydrogen carbonate.
14. A composition according to any of claims 1-3 wherein the encapsulating substance is a fatty substance selected from the group consisting of a monoglyceride, a diglyceride, a triglyceride and a mixture hereof.
15. A composition according to claim 14 wherein the fatty substance is in a crystalline state.

16. A composition according to claim 11 wherein the amount of encapsulating substance is at least 25 wt%, the amount of the acidic component is in the range of 0-60 wt% and the amount of the basic component is in the range of 0-60 wt%.
- 5 17. A composition according to any of claims 1-9 wherein one of the first and second components is a precursor for an aroma component which, when it is brought into interacting contact with the other of the first and second components is converted into the aroma component.
- 10 18. A composition according to claim 17 wherein one of the first and second components is an enzyme capable of converting the aroma precursor into the aroma compound.
- 15 19. A composition according to claim 1-9 wherein one of the first and second components is a hydrocolloid and the other of the first and second components is a salt which, when it is brought into contact with the hydrocolloid, causes the hydrocolloid to gel.
- 20 20. A composition according to claim 19 wherein the non-gelling hydrocolloid is a carrageenan and the salt is a calcium salt.
21. A composition according to any of claims 1-20 which is in the form of particles having an average largest diameter in the range of 50 μm to 1000 μm .
- 25 22. A method of preparing a food product, comprising adding a composition according to any of claims 1-21 to a food product system and processing said system under conditions whereby the components are brought into an interacting contact.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/DK 98/00075

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A21D2/02 A23P1/04 A23L1/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A21D A23P A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 411 326 A (BIO-DAR LTD) 6 February 1991 see page 3, line 27 - page 5, line 13 ---	1-10, 13, 19-24
X	US 3 930 032 A (N.E. HARRIS ET AL.) 30 December 1975 see column 2, line 30 - line 63; claims ---	1-9, 13, 20-23
X	GB 1 400 972 A (PATENT TECHNOLOGY, INC.) 16 July 1975 see claims ---	1, 2, 9, 10, 20-23
X	EP 0 156 573 A (NABISCO BRANDS, INC.) 2 October 1985 see page 6, line 17 - line 27 see page 9, line 5 - page 10, line 14; claims ---	1, 2, 5-10, 13, 14, 20-23
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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